FUTUREWATER Modeling Indiana's future water supply

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Like many states, Indiana is highly reliant on water for jobs, economic development, and drinking water. In fact, Indiana's economy is one of the most water reliant states in the country. Water provides Hoosiers with the ability to grow crops, manufacture goods, generate electricity, and support ecosystems as Indiana's climate has been characterized by plentiful water from rainfall.

With climate change impacting the frequency, intensity, and distribution of precipitation in the Midwest, will there be enough water to support Hoosiers' economy and way of life in the years to come? To answer this question, Indiana University's Environmental Resilience Institute commissioned the FutureWater project to forecast water availability across a wide swath of the state through 2100.

What is FutureWater?

Indiana University researchers developed a highly detailed model of Indiana's largest watershed, the Wabash River Basin, which covers about two-thirds of the state, to better understand how changes in climate will affect surface water and soil conditions.

To promote collaborative research and inform water stakeholders throughout the state, IU researchers and staff created the FutureWater science gateway, a public interactive data portal that allows users to explore projections under several different climate scenarios.

How was the Wabash River Basin model created?

The model combines Indiana-specific datasets, including elevation, land use, land cover, soil types and streamflow, with hydrological modeling software produced by the US Department of Agriculture and an ensemble of climate models provided by researchers at the University of Notre Dame and applied in the latest Indiana Climate Change Impacts Assessment Report.

IU researchers developed the regional-scale watershed model on IU's formidable computing infrastructure, including the Big Red series supercomputers.

What information is available through the FutureWater science gateway?

The FutureWater science gateway allows users to view projected changes in precipitation, soil, and waterways for smaller-scale, very localized watersheds at multiple future time periods and under different global carbon emissions scenarios. Results are available as maps and graphs.

Research data are also available to download, giving researchers the opportunity to conduct their own analyses, update the existing model or run entirely new models.

## How can FutureWater data be applied?

Beyond water management, FutureWater research data could help advance solutions in agriculture, wastewater treatment, land use and species migration, among other applications.

Collaborators can run their own models by modifying the input files or mining the huge caches of modeling output files stored on IU's supercomputing infrastructure to answer questions related to their own disciplines.

FutureWater projections

Rising temperatures will decrease soil moisture and increase hydrological drought, meaning Indiana's soil and streams will likely be drier for longer periods of the year, especially during the summer.
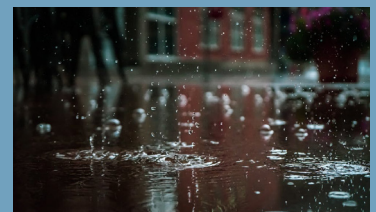
While annual precipitation levels will be about the same, there will be more rain in the winter and spring and less in summer and fall, leading to greater variability in surface water levels throughout the year.

Increased temperatures will contribute to higher levels of evaporation and less water for streams and agricultural use.

Changing the way research is communicated

By making FutureWater data publicly available and accessible, ERI is striving to prepare Indiana for environmental change by connecting experts and government leaders in the state to critical planning resources.

Here are a few ways FutureWater can be used:

General public: Citizens, policymakers, and others can analyze the projections for their community and plan accordingly.

Education: Teachers, professors, and researchers can work with their students to conduct research projects using FutureWater data.

Expert stakeholders: Government management offices, industry professionals, environmental groups, and external researchers can work with the FutureWater team to access the model and run their own analyses.

ERI: ERI researchers are working to incorporate the data into their own research in the fields of migratory ecology, invasive species, green infrastructure, the Hoosier Resilience Index, and more.

Agriculture and land use: Managers and farmers can see the predicted water availability and make management and planning decisions using the data.

What is next?

FutureWater is a dynamic tool that will continue to adapt and change as more data become available and new use cases arise. Future enhancements to the model include:
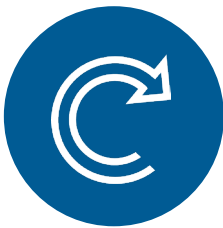
Periodic updates: More robust datasets will be input into FutureWater to increase forecast accuracy as they become available.

Interactive tools: The FutureWater team is working to create new tools to communicate model results to non-technical audiences. The team is also working with users to build custom tools that suit specific needs.

Outside models: People in multiple sectors that work closely with hydrologic modeling can use all the FutureWater framework has to offer. The team will work with these power users to help them run their own models to prepare for the environmental changes to Indiana's water resources.